

PATENT SPECIFICATION (11)

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- (21) Application No. 21706/78 (22) Filed 23 May 1978 (19)
 (61) Patent of Addition to No. 1 552 853 dated 23 Sept. 1977
 (44) Complete Specification published 9 Dec. 1981
 (51) INT. CL.³ B42D 15/00
 (52) Index at acceptance
 B6A C12 C31 C41 C72 L
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(54) IMPROVEMENTS IN OR RELATING TO SECURITY DEVICES

(71) We, THE GOVERNOR AND COMPANY OF THE BANK OF ENGLAND, a British Body Corporate, of Threadneedle Street, London EC2R 8AH, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to security devices and more particularly to devices for authenticating various items of sheet material, such as banknotes and other valuable documents, 15 passes, credit cards, security personnel passes, tickets and the like. The invention also relates to a method of making an authenticated item of sheet material.

20 The purpose of such authentication devices is the prevention of successful forgery, by making use of manufacturing techniques which involve extremely difficult manufacturing processes and/or very costly materials and apparatus. This will reduce the profitability of forging the document to a sufficiently high standard to achieve acceptable 25 resemblance to the original or authentic document, provided that poor imitations will be readily recognisable.

30 With specific reference to banknotes, it is currently known to produce the banknote paper or other sheet material with an inlaid strip of metal or other material of which the optical characteristics of light transmittance and/or reflectance differ from those of the 35 paper. Whilst the technique does itself involve the use of costly and complex equipment, the recognition by a non-expert of a true authentic note by the positive identification of an included thread of the correct type of material is not in all circumstances as 40 certain as might be desired. For example, it is usually necessary to hold the note against the light to observe the difference in optical transmittance between the strip and the note paper. In low light conditions this procedure 45 may not produce sufficient contrast for a reliable judgment to be formed as to whether a thread is actually enclosed in the paper rather than the appearance of such a thread 50 being given by a line drawn or printed on the

surface and whether the thread (which is not normally directly visible) is of the correct type and material.

Also, mechanised note sorters and checkers which operate by scanning the strip 55 optically respond only to the contrast and are generally unable to determine reliably that the strip exists within the sheet material.

The term "thin marking element", as used herein, means a "linear element" other than 60 a thin film dichroic filter element disclosed in copending British Patent Application No. 39820/76 (Patent No. 1552853), and the term "linear element" means a narrow strip or 65 thread.

The term "aperture", as used herein with respect to a sheet element as defined means an opening extending from one surface of the sheet element toward the authenticating 70 device and through at least part of the thickness of the sheet material overlying said device.

According to a first aspect of the invention, there is provided a sheet element incorporating an authenticating device comprising a thin marking element, as hereinbefore defined, 75 disposed within the thickness of the sheet element and having different characteristics of light transmittance and/or reflectance than the adjacent material of the sheet element and wherein portions of the thin 80 marking element are each visible through an respective one of a plurality of apertures, each aperture being formed in the sheet element to one side of the said thin marking 85 element.

According to a second aspect of the invention, there is provided a method of making an authenticated sheet element incorporating an authenticating device comprising a thin marking element, as hereinbefore defined disposed within the thickness of 90 the sheet element and having different characteristics of light transmittance and/or reflectance than the adjacent material of the sheet element, wherein in the region of each 95 of a plurality of portions of the thin marking element a respective one of a plurality of apertures is formed in the sheet material to one side of the thin marking element, to 100 make each said portion of the thin marking

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element visible.

Preferably said apertures form a predetermined regular or irregular aperture pattern and at least one location of the sheet element where an aperture is formed, an aperture of the same or different shape may be formed in the sheet material to the other side of the thin marking element to render visible the said other side at the respective portion. Where such a pair or pairs of superposed apertures is or are formed, the optical characteristics of both reflectance and transmittance of the thin marking element at the respective location or locations may readily be observed.

According to a third aspect of the invention there is provided a sheet element incorporating an authenticating device comprising a linear element, as hereinbefore defined, disposed within the thickness of the sheet element and having different characteristics of light transmittance and/or reflectance than the adjacent material of the sheet element and wherein in the region of each of a plurality of portions of the linear element the sheet material is formed with a respective one of a plurality of apertures, there being for each portion on one side only of the said linear element, whereby each said portion is visible.

According to a fourth aspect of the invention there is provided a method of making an authenticated sheet element incorporating an authenticating device comprising a linear element, as hereinbefore defined, disposed within the thickness of the sheet element and having different characteristics of light transmittance and/or reflectance than the adjacent material of the sheet element, wherein in the region of each of a plurality of portions of the said linear element a respective one of a plurality of apertures is formed in the sheet material to one side only of the said linear element to make the said portion visible.

The said apertures may be formed at respective regularly or irregularly spaced locations on the sheet element to form a predetermined pattern. The said apertures may all be formed to the same side of the linear or planar element, or to different sides at the different locations.

Preferably, each aperture physically exposes the respective portion of the authenticating device, and is formed by removal of the sheet material at the respective location by a controlled cutting, abrading or burning process, to a depth corresponding to the thickness of the sheet material overlying the authenticating device at that location in the basic, unworked sheet material.

The spacing pattern of the apertures may provide coded information corresponding, or related to some other characteristic of the sheet element, such as the denomination of a banknote, the price of a ticket, etc.

If the authenticating device is in the form

of a narrow strip, the strip may have straight, parallel edges or may be provided with at least one non-rectilinear edge. If both of the strip edges are non-rectilinear, the strip may follow a regularly or irregularly oscillating path of, for instance, wavy or zig-zag configuration, the periodicity, or amplitude of which may provide further coded information concerning the sheet element.

The authenticating device may be made from any desired material, for instance metallic, plastics, or fibrous material. This material may be constructed to exhibit particular desired optical characteristics. For example, the colour of the light transmitted may be different from that of the light reflected, and in the case of certain thin film dichroic filter material as disclosed in British Patent Application No. 39820/76 (now Patent No. 1552853), the material including a plurality of stacked layers of different materials, the said colours of the transmitted and reflected light may vary with the angle of incidence of illuminated light. For the avoidance of doubt these thin film materials are applicable only in the third and fourth aspects of the present invention.

Some embodiments of the invention will now be described by way of example with reference to the accompanying drawing, in which:

Figure 1 is a plan view of a banknote incorporating a security device according to the invention;

Figure 2 is an enlarged section through a portion of the banknote of Figure 1 taken on lines II—II;

Figure 3 is a plan view of another banknote incorporating a security device according to the invention;

Figure 4 is an enlarged section through a portion of the banknote of Figure 3 taken on line IV—IV;

Figure 5 is a plan view of a further banknote incorporating a security device according to the invention;

Figure 6 is an enlarged section through a portion of the banknote of Figure 5, taken on line VI—VI; and

Figure 7 is an enlarged section through another portion of the banknote of Figure 5, taken on line VII—VII.

With reference to Figures 1 and 2, a banknote 1 is formed with a narrow strip-like marking element 2 as herein defined, having different characteristics of light transmittance and/or reflectance than the material of the sheet element, and of, for example metallic or plastics material extending across the width of the note and disposed within the note thickness. In order to make the element 2 visible, the material of the note is formed at points 3 spaced along the length of the element with apertures. In this particular embodiment the apertures are arranged in

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pairs, the apertures of each pair being mutually superposed with the strip extending therebetween so that at east point 3, both sides of the strip are visible. However, at each
5 such point 3, the sheet material may alternatively be apertured to only one side. In this alternative arrangement the apertures may be all on the same side, or on randomly, or selectively determined opposite sides of the
10 strip.

The provision of such apertures enhances the effectiveness of the strip as a security device, since on the one hand production of the apertures to the controlled depth and shape is a difficult process involving costly
15 equipment, and on the other hand the visual and preferably physical exposure of the strip indicates more readily than hitherto the actual presence of the strip in the authentic note. These two factors render the successful
20 simulation of the note by unauthorised persons unlikely by reducing considerably the profitability of such activity. Furthermore, by virtue of the specialised nature of the necessary equipment, monitoring of the sales
25 of such equipment will facilitate detection of the possession by persons or organisations other than legitimate users.

The note may be produced from sheet material made by any suitable technique with the strip inlaid. Such sheet material may comprise a continuous elongate web having a continuous thread. This web may be fed into
30 an aperture forming machine which might use a cutting or laser burning technique, but preferably an abrading technique to remove the sheet material lying on one or both sides of the strip at the desired locations.

This apertured web may then pass to the
40 printing and cutting stations. It will be appreciated that this is just one of a number of possible alternative sequences of the steps necessary for note production.

Whilst these apertures are illustrated as
45 rectangular in Figure 1, any other desired shape may be used, and the spacing, size and/or shape of the apertures along the strip may be related to some feature of the banknote such as the denomination or issuing authority.

Furthermore, in contrast with the embodiment of Figures 1 and 2, the width of the apertures may be greater than the width of the strip.

55 The banknote illustrated in Figures 3 and 4 incorporates an authenticating device comprising a marking element 4, as herein defined in the form of a wavy strip 5. This strip is, as before, disposed within the thickness of the sheet material of the note. At
60 locations 6 spaced along the strip, the sheet material is apertured on both sides of the strip to make the strip visible at these locations. The pairs of superposed apertures
65 7 are, in this embodiment, circular and of

diameter greater than the width of the strip, though any desired shape, size and spacing may be employed, and the sheet material may, if desired, be apertured at each location
70 6 to one side only of the strip. The amplitude and/or periodicity of the oscillatory path which the strip follows may also present data related to a characteristic of, or printed information on the banknote, as disclosed in
75 copending British Patent Application No. 8628/77 (Serial No 1580951). The strip may be formed with one straight and one wavy edge, the latter carrying the aforesaid data.

With reference to Figures 5 and 7, an embodiment is illustrated in accord with the
80 third and fourth aspects of the present invention.

A banknote 9, constituting a sheet element incorporates a security device comprising a linear element in the form of a narrow strip
85 10 of any desired material, including the thin film material as defined herein and disclosed in copending Application No. 39820/76 (Patent No. 1552853). This strip 10 extends across the width of the note, and at each of a plurality of locations 11 spaced therealong the sheet material 12 is apertured to one side
90 only of the strip to make the strip visible. Once again, the apertures may be of any desired shape size and spacing, and these characteristics may present data related to a feature of the note. In the embodiment illustrated the apertures are formed on alternate sides of the strip, though it will be
95 appreciated that they may all be formed on the same side.

In all of the foregoing embodiments, the apertures need not be of uniform shape and size. For example where apertures are formed on both sides of the authenticating
105 device, those on one side may all be of one configuration while those on the other side may be of a different configuration.

WHAT WE CLAIM IS:—

110 1. A sheet element incorporating an authenticating device comprising a thin marking element, as hereinbefore defined disposed within the thickness of the sheet element and having different characteristics
115 of light transmittance and/or reflectance than the adjacent material of the sheet element and wherein portions of the thin marking element are each visible through a respective one of a plurality of apertures,
120 each aperture being formed in the sheet element to one side of the said thin marking element.

2. A sheet element according to claim 1 wherein at the, each, or at least one location
125 on the sheet element where an aperture is formed to one side of the thin marking element, an aperture is formed in the sheet material to the other side of the thin marking element to render the said other side visible. 130

3. A sheet element according to claim 2 wherein at the or each of the locations where an aperture is formed to the other side of the thin marking element, that aperture is of different shape or dimension to the aperture formed to the said one side at that location.

4. A sheet element incorporating an authenticating device comprising a linear element, as hereinbefore defined, disposed within the thickness of the sheet element and having different characteristics of light transmittance and/or reflectance than the adjacent material of the sheet element and wherein in the region of each of the plurality of portions of the linear element the sheet material is formed with a respective one of a plurality of apertures, there being for each portion an aperture to one side only of the said linear element, whereby the said portions are visible.

5. A sheet element according to claim 4 wherein the apertures are all formed to the same side of the linear element.

6. A sheet element according to claim 4 wherein different apertures are formed to different sides of the linear element.

7. A sheet element according to claim 2 or to any of claims 4 to 6 in which the apertures are of different shapes or dimensions.

8. A sheet element according to any preceding claim wherein each aperture physically exposes the respective portion of the authenticating device.

9. A sheet element according to any preceding claim wherein said apertures are arranged in a predetermined pattern which constitutes coded information corresponding, or related to a characteristic of the sheet element.

10. A sheet element according to claim 9 wherein the said characteristic comprises matter printed or otherwise visually provided on a surface of the sheet element.

11. A sheet element according to any preceding claim wherein the linear element is in the form of a strip of which at least one edge is rectilinear.

12. A sheet element according to claim 11 wherein both edges of said strip are rectilinear and parallel.

13. A sheet element according to any of claims 1 to 10 wherein the linear element is in the form of a strip of which at least one edge is non-rectilinear.

14. A sheet element according to claim 13 wherein the or each non-rectilinear edge follows an oscillatory path.

15. A sheet element according to claim 14 wherein the said path or paths is or are regularly oscillatory, and wherein the periodicity and/or amplitude of the or of at least one of the said edges constitutes coded information relating to the sheet element.

16. A sheet element according to any of

claims 11 to 15 wherein the, each or at least one aperture is wider, measured across the strip, than the strip.

17. A sheet element according to any preceding claim in the form of a banknote.

18. A method of making an authenticated sheet element incorporating an authenticating device comprising a thin marking element, as hereinbefore defined, disposed within the thickness of the sheet element and having different characteristics of light transmittance and/or reflectance than the adjacent material of the sheet element, wherein in the region of each of a plurality of portions of the thin marking element a respective one of a plurality of apertures is formed in the sheet material to one side of the thin marking element, to make each said portion of the thin marking element visible.

19. A method of making an authenticated sheet element incorporating an authenticating device comprising a linear element, as hereinbefore defined, disposed within the thickness of the sheet element and having different characteristics of light transmittance and/or reflectance than the adjacent material of the sheet element, wherein in the region of each of a plurality of portions of the said linear element a respective one of a plurality of apertures is formed in the sheet material to one side only of the said linear element to make the said portion visible.

20. A method according to either claim 18 or claim 19 wherein the or each aperture is formed by abrading the material to one or each side of the authenticating device to a controlled depth.

21. A method according to claim 20 wherein the said controlled depth corresponds substantially to the thickness of the sheet material overlying the authenticating device at the location of the respective aperture.

22. A sheet element substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

23. A method of making an authenticated sheet element substantially as hereinbefore described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son
(Abingdon) Ltd.—1981. Published at The Patent Office,
25 Southampton Buildings, London, WC2A 1AY,
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FIG. 1.

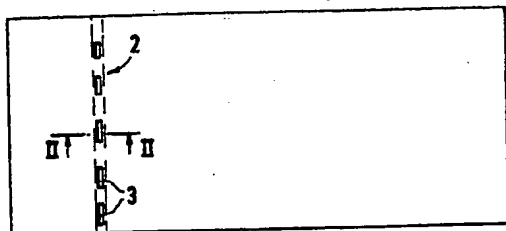


FIG. 2.

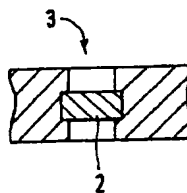


FIG. 3.

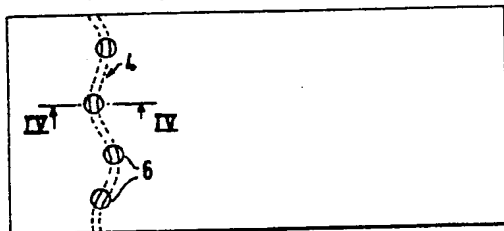


FIG. 4.

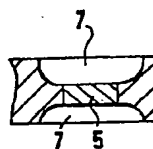


FIG. 5.

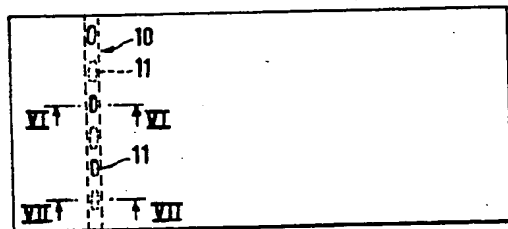


FIG. 6.

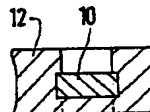


FIG. 7.

